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SPREAD OF EIGHT-ROWED MAIZE FROM THE PREHISTORIC SOUTHWEST

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THE origin and diffusion of maize (*Zea mays*) in the North American Southwest is of interest to both the maize breeder and the archaeologist. The interest of the maize breeder lies in his search for the sources of effective germplasm for use in the development of better maize hybrids. The archaeologist is interested in the history of maize because of its association with the growth and spread of those prehistoric cultures in which this cereal played a prime role.

BOTANICAL DATA

It is now apparent that most, if not all, of the races of Southwestern maize came from adjoining areas in Mexico, although, as will be discussed later, one race which was important to the evolution of this cereal may have come originally from South America. Both Mexico and the Southwest had the same ancient indigenous race, Chapalote, which underwent a slow evolutionary change for several thousands of years, until two separate and sudden evolutionary spurts were triggered by two new elements: first, teosinte, a wild relative of maize; and, later, an

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unrelated eight-rowed race of maize which survives in mixed form in a race called Harinoso de Ocho in northwestern Mexico (Mangelsdorf and Lister, 1956).

Chapalote reached the Bat Cave area in New Mexico apparently from central or southern Mexico perhaps as early as 3600 B.C. (Mangelsdorf, 1954), and, after a gradual evolutionary change leading to increased size of ear and increased number of kernel-rows, it became the Basketmaker maize which formed the subsistence base of the prehistoric Pueblo culture. The addition or introgression of teosinte germplasm into Chapalote occurred probably not later than 500 B.C. at Bat Cave (Mangelsdorf and Smith, 1949), and it seems to have spread as far north as Durango, Colorado by A.D. 46 to 330 (tree ring dates), as will be discussed later. The degree of such teosinte introgression can be estimated in archaeological cobs, and such estimates have been correlated with various changes in the morphology of the cob (Galinat *et al.*, 1956; Galinat and Ruppé, 1961). The effects of this teosinte germplasm include a tremendous increase in variability and an apparent heterotic effect on ear size as well as an increase in drought resistance which was necessary for an extension of maize culture into new and more arid regions.

Greater drought resistance in teosinte-contaminated maize may be of either a physiological or a morphological nature. The type of drought resistance derived from teosinte germplasm in maize reported by Reeves (1950) is apparently physiological. A morphological type of drought resistance in teosinte itself has been observed recently by Mr. Garrison Wilkes (personal communication), and this type may also be transferred to maize. After examining Mexican maize fields that showed serious drought damage and which contained Chalco teosinte, Mr. Wilkes concluded that the teosinte was more

successful in producing seed than the maize. He attributed this ability of teosinte to ward off drought to the fact that it produces a succession of younger ears in clusters which eventually encounter the late season rains necessary for grain development. A situation in which this morphological type of resistance has been transferred to maize was observed this past summer at the Bussey Institution in the race Reventador, which seems to be a teosinte-contaminated descendant of Chapalote and has some similarities to the teosinte-contaminated form of Chapalote that was prevalent in the Southwest before A.D. 700.

Apparently at about A.D. 700, a third element, the race of eight-rowed maize, Harinoso de Ocho, entered upon the evolutionary scene and conferred new benefits in the form of higher yield, easier milling and adaptability to a far greater range of environments. A re-examination of the earlier eight-rowed cobs from the Durango Basketmaker site described by Jones and Fonner (1954), has now revealed that their eight-rowed condition is probably a result of teosinte introgression into the race Chapalote.

Some of the differences between eight-rowed cobs resulting from teosinte introgression into Chapalote, such as those from Durango, and this new eight-rowed race, Harinoso de Ocho, are apparent in Plate XX. The tripsacoid element in eight-rowed Chapalote (figs. 1–4) is revealed by a combination of slender cobs which may be curved and have slender shanks with narrow, triangular shaped cupules and hard up-curved glumes. The Harinoso de Ocho element (figs. 5–12) is manifest in thick straight cobs which are sometimes swollen at the base, thick shanks, wide cupules and wide, crescent-shaped kernels. In describing this race, Wellhausen *et al.* (1952), postulated that it was introduced into Mexico

from South America in pre-Columbian times. Its South American progenitor was subsequently found in Colombia and identified by Roberts *et al.* (1957), as Cabuya, an eight-rowed race that is both tripsacoid and has nearly knobless chromosomes (average, 2.2 knobs). Grobman *et al.* (1961), suggested that these two features might result from indirect introgression, by way of Sabanero (1.5 knobs), from a South American species of *Tripsacum*, *T. australe*, which, as shown by Graner and Addison (1944), is unlike its knobby Central and North American relatives in having almost knobless chromosomes.

The blending of these three diverse germplasms from Chapalote, teosinte and Harinoso de Ocho produced, in Mexico and the American Southwest, new and more productive races of maize with increased adaptability sufficient to permit maize cultivation to spread north to northern Utah in the Great Basin. As this maize spread northward into the Dakotas in the Plains east of the Rocky Mountains and east across northern United States and on into New England, there was a filtering out of the eight-rowed element which became stabilized as the race called Northern Flint. Eventually, with the migrations of European farmers, these northern flints encountered the southern dents which had spread northward from eastern Mexico. The resulting hybridizations yielded the world's most productive race, our modern Corn Belt Dent, as shown by historical records (Wallace and Brown, 1956). The efficient use of these diverse germplasms which are now captured to various degrees in modern inbred lines of maize involves a knowledge of their origins and a recognition of their particular effects upon a spikelet-rachis relationship (Galinat, 1963).

There has been some confusion surrounding the origin and identity of this important eight-rowed race. This

confusion seems to stem from the fact that pure forms of the eight-rowed race are either rare or hidden by the great diversity of maize in the Southwest, while eight-rowed maize was abundant and often the only archaeological maize in the North or Northeast. Accordingly, most references to this race follow Carter's (1945) early term of "Eastern Complex," a term which was coined to indicate an Eastern origin. Others (Brown and Anderson, 1947) have referred to the same race as Northern Flint, a term which seems to be better than that used by Carter, since it does, at least, indicate the "Life Zone" (Plate XXI) where this eight-rowed race attained its greatest distribution (Plate XXII). But if we examine both the prehistoric and historic evidence concerning the distribution of this eight-rowed race, as will be done later, we find that its origin can be traced back to the Southwest, as first suggested by Mangelsdorf and Reeves (1939), and southward to the race Harinoso de Ocho in Mexico. The Spanish term "harinoso" refers to the floury character of the kernels, while "ocho" refers to the eight-rowed condition of the ears. In the East and Northeast, this race has acquired "flinty" kernels instead of the original floury ones. We are here proposing a more general name, Maíz de Ocho, for this race in which we include both the Northern Flints and Harinoso de Ocho. The Spanish name was chosen to give recognition to its Mexican point of dispersal.

An excellent historical record of the geographic distribution of the eight-rowed flint (varieties Angel of Midnight, Canadian Eight-rowed Yellow, King Philip and Longfellow) was published by C. S. Plumb in 1898 as a bulletin of the United States Department of Agriculture. This record is the more significant because, at this early date, before the advent of extensive commercial maize hybridization, the races and their distribution more

closely approximated the prehistoric condition. Since Plumb presented his distributional data only by states, the dots representing these occurrences on our Plate XXII are located arbitrarily within the states. Even so, his survey data revealed that Maíz de Ocho was best adapted, presumably because of suitable conditions of temperature and moisture, to the humid part (Alleghenian area) of the Transitional Life Zone; that is, especially to the Allegheny region, Ontario, New England, New York, Pennsylvania, Michigan, Wisconsin and Minnesota. This race also extended down through the arid part of the transition zone, where the soil was moistened by rivers, springs or sub-surface drainage from higher elevations or by intentional irrigation in parts of Nevada, Wyoming, Colorado, Utah, New Mexico and northwestern Mexico. But although this eight-rowed race was not well adapted to the Southwest, it became widespread there, which is in sharp contrast to its almost complete absence in the Lower Austral Zone in the Southeast (Plate XXI). These historical data suggest that Maíz de Ocho arrived in the Northeast by way of the Southwest.

Convincing evidence that Maíz de Ocho did indeed come from the Southwest becomes apparent when we extend the map of Brown and Anderson (1947) showing the prehistoric distribution of Maíz de Ocho to include all of the United States rather than just that part east of the Mississippi. With this archaeological data added to the historical data of Plumb, we find that Maíz de Ocho follows the Transition Life Zone from New England across the northern United States and down through the Southwest into Mexico (Plate XXII). Furthermore, the data on which this distribution is based (Table I) show that the closer one gets to Mexico, the earlier the dates for Maíz de Ocho. What at first appears to be the

most serious exception to this sequence of dates is the Maíz de Ocho from Stalling's Island Mound, Georgia, where the major occupation probably pre-dates the Christian era. It is not possible, however, to determine, without radiocarbon dating, whether this eight-rowed maize is from this earlier occupation or from a later historic occupation (A.D. 1600–1700) which followed at the same site. The later occupation seems more likely.

If Maíz de Ocho did originate in the highlands of Colombia, then its poor adaptation to the lowlands in the southern part of the Southwest might be expected. But a flow of germplasm from local races such as Chapalote, Reventador and Tabloncillo has apparently tended to acclimatize it to this area. Thus, Harinoso de Ocho, as it lingers on, is extremely variable and mixed. Each ear from two collections of Harinoso de Ocho recently received from the Rockefeller Foundation in Mexico is different in size and shape and has thin dented kernels rather than thick floury kernels, as described for this race by Wellhausen *et al.* (1952). Although the kernels of Harinoso de Ocho are thinner (4.4 mm.) than those of Cabuya (6.36 mm.), they are still thicker than those of all other Mexican races except one, Cacahuacintle, which is thought to be also from South America and to be related to Cabuya (Wellhausen *et al.*, 1952 and Grobman *et al.*, 1961). The mixed nature of Harinoso de Ocho is also apparent in archaeological collections from northwestern Mexico (Mangelsdorf and Lister, 1956) and adjoining areas of the Southwest, as in a collection from several sites in southwestern New Mexico reported by Cosgrove (1947) and represented in Plate XXIII. This collection shows the distinct elements which were blended during the evolution of maize in the Southwest as follows: Chapalote (figs. 1, 2, 3), tripsacoid Chapalote

(figs. 4, 5, 6) and Harinoso de Ocho (figs. 7, 8, 9) as well as their hybrid product, probably the Pima-Papago race, or Maíz Blando (figs. 10, 11, 12).

As Maíz de Ocho moved northward and eastward from the Southwest, it would have encountered colder soils and shorter growing seasons. As a result, natural selection, especially during germination, would have increased the frequency of the hard, flinty kernels and early maturing kernels. At the same time, natural selection would have filtered out any residual adaptation to the growing conditions which are found in the North and Northeast. Such germplasm might have been carried over through the poorly adapted Harinoso de Ocho in Sonora from the introduced highland race Cabuya of Colombia. Thus, during its northward migration from the Southwest we would have had the well-known substitution of latitude for altitude adaptation resulting in this reassertion of the original South American heritage.

This new eight-rowed race had certain advantages over the indigenous Chapalote race in that its larger and softer kernels were easier to grind for flour. When the problem of adaptability was overcome by hybridization with indigenous maize, the new superior type of grain must have spread rapidly, probably through trade and migration. The hybrid, called Maíz Blando de Sonora by Wellhausen *et al.* (1952), remained in Mexico. It has floury kernels approaching those of Harinoso de Ocho in size and a twelve-rowed ear approaching that of Chapalote. Just to the north, the counterpart of this hybrid is called Pima-Papago after the Indians who cultivated it (Anderson and Cutler, 1942). Teosinte introgression seems also to have played a role in the spread of this hybrid, especially in the Fremont area of Utah, where the kernels become strongly dented and the glumes indurated (Plate XXIV). The close similarities among the races Maíz

Blando de Sonora, Pima-Papago and Fremont Dent are seen in Plate XXV).

The denting of kernels in Pima-Papago to produce the Fremont Dent apparently allowed a more northerly extension of the culture of this hybrid race. The dent type of kernel has some of the advantages of both the hard, flinty kernels which are more resistant to decay in cool moist soils and the soft, floury kernels which are easier to grind for flour. The dent itself refers to a depression which develops in the crown of the kernel and extends toward the column of soft starch which occurs in the central region of the kernel. The sides of dent kernels are flinty and, thereby, provide protection against decay in the region most susceptible. During germination, the column of soft starch expands toward the crown, causing the dent to disappear.

The degree of denting is variable in different races of maize and appears to be one of the effects of teosinte introgression. Denting is correlated with the number of chromosome knobs, which in turn is related to tripsacoidness in the maize from western Guatemala (Mangelsdorf and Cameron, 1942) and in the maize from the United States (Brown, 1949). Since there is at most only slight denting in Chapalote even where there is extensive teosinte introgression, it was apparently the introduction of Maíz de Ocho germplasm combined with the tripsacoid Chapalote germplasm that made denting possible.

Although most collections of Fremont Dent appear to be merely a dented form of the Pima-Papago race, apparently some of its northernmost isolates have acquired slightly more pointed kernels and shorter ears than the Pima-Papago race and, consequently, have some superficial resemblance to the race called Zapalote Chico. In fact, it has been suggested that Zapalote Chico jumped about one thousand miles from central Mexico to the

Castle Park area in northwestern Colorado (Anderson, 1959), although the present distribution of this race is even farther south in the southernmost Mexican states of Oaxaca and Chiapas.

The most Zapalote Chico-like specimen which we were able to pick out of the Peabody Museum Collection from Fremont sites is from near Vernal, Utah, not far from Castle Park. This specimen matches very closely the ears from Castle Park which Anderson (1959) has called Zapalote Chico, but its resemblance to Zapalote Chico is not convincing when it is compared with actual specimens of this race obtained through Dr. E. J. Wellhausen of the Rockefeller Foundation in Mexico (Plate XXVI). Any similarities which exist between the Castle Park maize and Zapalote Chico may stem from the fact that Zapalote Chico and our candidate, the Pima-Papago race, have some similarities in their ancestry, as pointed out by Mangelsdorf (personal communication). That is, Nal Tel, one parent of Zapalote Chico, is either related to or else is the actual precursor of Chapalote, which is one parent of Maíz Blando (Pima-Papago). Furthermore, both hybrid races involve teosinte introgression, coming by way of the race Tepecintle in the case of Zapalote Chico and coming in more directly during the origin of Maíz Blando from Harinoso de Ocho and Chapalote (see Wellhausen *et al.*, 1952).

Archaeological Implications

This re-examination of the origin and spread of Maíz de Ocho has far-reaching implications for the archaeology of the Southwest, especially the Pueblo II expansion; for the beginnings of sedentary cultures in the Plains east of the Rocky Mountains; and for the development of cultures across the northern part of the United States as far as the Atlantic Ocean. Considering the very limited

data with which we are dealing and the inherent imprecision of radiocarbon dating, which provides much of our chronological framework, it cannot be emphasized too strongly that the reconstructions here outlined, especially those concerning eastern United States, are of a tentative nature.

It has already been pointed out that pre-Chapalote, the maize introduced from Mexico into the American Southwest some 5000 years ago, developed quite slowly, until teosinte was introduced, also from Mexico, by about 500 B.C. Pre-Chapalote has been recovered from the earliest, but undated, levels at Swallow Cave in Chihuahua (Mangelsdorf and Lister, 1956) and from the earliest, perhaps 5000-year-old level, at Bat Cave in southwestern New Mexico (Johnson, 1951; Mangelsdorf, 1954).

More evolved, teosinte-contaminated, early Chapalote was recovered from a 2300-year-old level at Tularosa Cave in southwestern New Mexico not far from Bat Cave (Cutler, 1952; Johnson, 1951). The highly variable hybrids that resulted from the blending of Chapalote and teosinte provided the base for the Basketmaker and Pueblo development. By the beginning of the Christian era, the Basketmaker horticultural way of life had spread north into southern Utah and southwestern Colorado. A number of sites in this area that have yielded early and evolved types of Chapalote showing varying amounts of teosinte contamination have been dated by dendrochronology. Among these are Cave du Pont (A.D. 217) in south-central Utah (Collins, *in*: Nusbaum, 1922; Schulman, 1949); White Dog Cave (A.D. 312), as well as other sites in the Marsh Pass area of northeastern Arizona (Kidder and Guernsey, 1919; Guernsey and Kidder, 1921; Gladwin, 1957: 37); and the Durango Basketmaker site (A.D. 46–330) near Durango in southwestern Colorado (Morris and Burgh, 1954).

At about A.D. 700, the new race of maize that we have named Maíz de Ocho made its appearance in northern Mexico, where it survives in a race called Harinoso de Ocho. Our data are still too few to establish with certainty the routes by which Harinoso de Ocho traveled. No evidence of its influence has been noted between its postulated homeland in South America and northern Mexico. From the location of the few sites in the latter area where it has been found, the most likely route would have been up the west coast of Mexico. It seems probable that it was also introduced into Central America and southern Mexico, but since this race is especially well suited to high latitudes or altitudes, it is not surprising that no evidence of it can be seen in the maize of this tropical area. Once it reached northern Mexico, however, it apparently spread very rapidly throughout the Southwest, where it occurs at Tularosa Cave at about the same time that it appears in Chihuahua. Since it was crossing an area which had long contained other maize, some of the new germplasm probably spread in the form of a hybrid.

Our re-examination of some of the charred cobs from the Durango, Colorado Basketmaker site that were originally thought to show a significant amount of "Eastern" (Maíz de Ocho) influence, led to the conclusion that the traits in question were more probably the result of teosinte introgression. Thus, with the cancellation of this material as evidence of Maíz de Ocho in a Basketmaker context, we can probably rule out its occurrence in the Southwest prior to about A.D. 700, when it entered the Mogollón area.

The addition of this new race appears to have given a second and even more potent impetus to the development of the already well-adapted maize in the Southwest. By sometime between about A.D. 950 and 1100, the area occupied by the Pueblo cultures reached its

maximum extent with what is known as the Pueblo II expansion; and throughout the Southwest, after about A.D. 950, the archaeological maize shows a blending of Chapalote, teosinte and Maíz de Ocho. The persistence until at least A.D. 1247 of essentially pure Maíz de Ocho, along with other strongly Chapalote-affiliated maize, is dramatically shown at Painted Cave, northeastern Arizona (Haury, 1945, Plate 36).

The reason for the Pueblo II expansion into areas not previously occupied by horticulturists has not been satisfactorily explained. A period of more favorable rainfall has generally been accepted as one factor. We are suggesting here that a more important factor was the introduction of the new race of maize, Maíz de Ocho, which, when blended with the previously cultivated maize, resulted in more abundant yields of a grain that was not only more easily milled, but also better suited to a wider range of environments, particularly higher elevations and latitudes. Thus, the introduction of Maíz de Ocho appears to have provided a food resource that contributed to a population increase, and a maize sufficiently adaptable to higher latitudes that it permitted this increased population to carry the Pueblo farming way of life an additional 250 miles farther north than had previously been possible. Although the Pueblo area spread limited distances both east and west during this period (ca. A.D. 900–1100), the most dramatic expansion was to the north, with the movement of the Fremont and Sevier (probably Plateau Shoshonean) peoples into the northern 85% of Utah (Gunnerson 1960, 1962).

This study started with an examination of maize remains collected by the Claflin-Emerson Expeditions to eastern Utah sponsored by Peabody Museum of Harvard between 1928 and 1931. The archaeology of some of these sites has been described previously by Morss (1931)

and that of the remainder has been described recently by Gunnerson (n.d. b). This very interesting and important maize collection contains excellently preserved specimens from Fremont sites well distributed over that part of eastern Utah north of the Colorado River. The collection includes 226 ears, cobs and fragments of cobs in which a complete cross section is retained, plus other miscellaneous maize remains. A full tabulation and description of this material is in preparation, but only sites yielding definite evidence of Maíz de Ocho are included in Table I of this report. About 10% of the Fremont maize examined is eight-rowed, but some of these specimens show strong tripsacoidness. On the other hand, however, some ten- and twelve-rowed specimens show significant increcrements of Maíz de Ocho.

A few of the samples of Fremont maize were found in isolated rock shelters without associated diagnostic artifacts. However, since these sites are in areas where the Fremont Culture is the only horticultural archaeological complex, it is safe to assign these finds to Fremont. The finding at other sites of Maíz de Ocho specimens associated with diagnostic Fremont artifacts and with a wide range of other maize, mostly that here defined as Fremont Dent, helps substantiate the assignment of the isolated finds.

Other archaeological maize from the Southwest that has been examined or re-examined includes portions of the Peabody Museum Collections made by Guernsey and Kidder in northeastern Arizona and by Cosgrove in southwestern New Mexico. These two collections represent the Kayenta Anasazi and Mogollon cultures, respectively.

Certain changes that took place in the Pueblo II period, when considered along with the advent of Maíz de Ocho, raise questions such as the following: Did the

greater ease with which the new maize could be milled cause changes in the design of *manos* and *metates*, such as the use of mealing bins and the graded coarseness of the metates? Did the increased yields provided by the new maize result in changes of settlement pattern and village plan, as well as changes in architectural styles, such as increased size of storage rooms? Did the increased yields make the Pueblo people overly dependent upon maize horticulture so that the occasional inevitable crop failures, especially when they occurred for several consecutive years, cause severe hardships and increased inter-village competition for the most desirable farm land, and even raids against villages which did harvest a successful crop by another village which did not? Was the moving of storage rooms into large multiroomed structures a device for protecting the surpluses that could now be amassed? These and many other questions can probably be answered by additional field work and a re-examination of data now available.

With regard to the area east of the Rocky Mountains, there are scattered bits of evidence (Caldwell, 1958) that maize was grown in various places in the southeastern quarter of the United States probably as early as the last few centuries B.C. It is uncertain, however, just how important maize was in the Hopewell Culture with which these scattered finds of maize have been most commonly associated. Very little maize has been recovered, but this could be due in part to poor conditions for preservation. The best description of Hopewell maize appears to be that by Cutler (*in:* McGregor, 1958: 169–170) based on 106 grains, but no cobs, from the Pool Site, a Hopewell village in west-central Illinois. These grains appeared to be from ears with 10 to 14 rows, mostly 12, and similar to maize from the upper prepottery and lower pottery levels at Tularosa Cave. Cutler states that "The ears

probably resembled the Guatemalan Tropical Flints more than they resembled the historic ears of the region'' and that ''The grains probably were flint, but might have been flour. They were not sweet, pop, or dent.''

The only direct evidence of maize in Plains Woodland (ca. A.D. 0–900) consists of a few kernels found in eastern Nebraska at a site assignable to its latest phase (Kivett, 1952; Wedel, 1961). Of this maize, Mangelsdorf (*in:* Kivett, 1952: 58) said ''their size and shape is such as to indicate they are popcorn not too different from the primitive popcorn from Bat Cave dated at 1500 to 2000 B.C. This does not mean, of course, that this particular corn was grown at such an early date but there is no doubt that it represents a relatively primitive type of corn.''

Thus, there is no chance that either the Hopewell or the Woodland maize is closely related to Maíz de Ocho, nor is it likely that either was involved in any way with the spread of Maíz de Ocho prior to its appearance in the Southwest. The data are still too few to permit safe speculation on the relationship between Plains Woodland maize and Hopewell maize. Although Plains Woodland was contemporaneous with at least Late Hopewell and was apparently related to it both culturally and by trade, we can not be certain of even the relative chronological relationship between the maize described for each. Both races, however, appear to be derivable from the Chapalote maize occurring even earlier in the Southwest.

East of the Rocky Mountains, the earliest dated occurrence of something resembling Maíz de Ocho is at the Davis Site in eastern Texas, as described by Jones (1949). We borrowed samples of charred cobs taken from this site and concluded that they might have been from a small-eared type of Maíz de Ocho because of their

eight-rowed condition and wide, glabrous cupules; but positive identification as such cannot be made. There is a possibility that they may be of a different origin. For example, specimens resembling these and derived from mixtures of early Nal Tel and Chapalote come from El Riego Cave, excavated by R. S. MacNeish in the state of Puebla (unpub.). Archaeological Nal Tel, which is eight-rowed with wide but hairy cupules and dated at about 4445 years ago, comes from much nearer Texas in the state of Tamaulipas in northeastern Mexico (Mangelsdorf *et al.*, 1956).

The Davis site maize was originally dated by radiocarbon, using the "carbon black" method, at A.D. 398 ±175 (Johnson, 1951). More recently, the University of Michigan laboratory arrived at a date of A.D. 1307 ±150 for this site, a date which is more in accord with archaeological evidence, although it is somewhat later than expected (Griffin and Yarnell, 1963). The actual age for the site may lie between these two dates; perhaps a conservative guess would put it at ca. A.D. 800–1000. In any case, the date would not be too early to preclude Maíz de Ocho from having spread to the Davis Site from northern Mexico via the Southwest, the interpretation most compatible with the available data. This spread could very easily be an extension of the ca. A.D. 700–1100 dispersal of Maíz de Ocho in the Southwest, but without Pueblo culture accompanying the maize to eastern Texas.

At about A.D. 1000, the first sedentary horticultural complexes appear, apparently full blown, in the Central Plains, extending as far north as northern Nebraska. The best known of these cultures are the Upper Republican Aspect of central and western Nebraska and western Kansas, the Nebraska Culture of eastern Nebraska and northeastern Kansas, and the Smoky Hill Aspect of cen-

tral Kansas. These three complexes, which together form the Central Plains phase or tradition, persisted until sometime between ca. A.D. 1450 and 1550, ending probably earlier in the west and later in the east. South of the Central Plains phase, and at least partly contemporaneous with it, are similar and perhaps related complexes such as the Antelope Creek Focus of the Texas Panhandle and the Washita and Custer foci of Oklahoma. Wedel (1959: 628) states, "The origins of the Central Plains tradition remain to be worked out. That it is basically of eastern or southeastern derivation seems clear. The square earth lodge is well known from prehistoric cultures farther south, in eastern Oklahoma and Arkansas; and as we have seen, there is direct evidence of contacts between Smoky Hill valley sites and the lower Arkansas valley. More accurate determination of chronology in the two areas is needed before we can be certain of the significance of the contacts."

It is specifically with the Arkansas River area that Southwestern cultures apparently had contacts in the lower Mississippi drainage at about A.D. 700 (Jennings, ed., 1959: 84–86). With some sort of relationship already established between the Southwest and the Arkansas River area, it is reasonable to assume that Maíz de Ocho would have reached this area as soon as it did the Davis Site 275 miles straight south. The Arkansas River area, could, in fact, have served as a point from which Maíz de Ocho was dispersed north, south and east. The lack of Southwestern trade items at all of the numerous sites of the Central Plains phase, whereas such trade material is relatively abundant in later periods (Wedel, 1961), helps support the idea that Maíz de Ocho did not enter the Central Plains directly from the Southwest.

In the Central Plains, Kivett (1949, p. 280) reported maize cobs with six to twelve rows from Upper Repub-

lican sites in southwestern Nebraska. Our examination of charred cobs in the Peabody Museum Collection from Nebraska Culture sites in eastern Nebraska revealed a very strong Maíz de Ocho component with eight-rowed cobs present from about half of the sites.

Although the development from Upper Republican or Nebraska Culture through Lower Loup into Pawnee and Arikara, as suggested by Strong (1940, 382), has not been definitely established, it is generally thought probable; and no other equally plausible fate for the Upper Republican people or origin for the Pawnee and Arikara people has been advanced. In earliest historical times, Pawnee, along with the very closely related Arikara to the north and Wichita and Caddo to the south, formed a nearly solid Caddoan-speaking bloc extending from Texas into South Dakota. Much about the culture of these tribes relates them closely to the southeast. Thus, it seems probable that the Caddo Tribe of Texas remained near the Proto-Caddoan homeland, while the Wichita, Pawnee and Arikara moved north.

When these various lines of evidence are considered together, they suggest that the spread of maize in the Plains probably paralleled the spread of maize in central and northern Utah. The introduction of Maíz de Ocho into the part of the Southeast contiguous to the Southern Plains may have triggered a population expansion that resulted in a movement of people into the Central Plains, which had not been suited to the growing of the kinds of maize previously available. Furthermore, it seems very likely that Maíz de Ocho and the Central Plains tradition which it made possible were both carried by speakers of Caddoan languages. Because the western part of the Plains, especially, was environmentally precarious for the growing of maize, decreased rainfall in the 1400's probably caused a withdrawal of these prehistoric farmers to the northeast.

In spite of the great amount of archaeological salvage work done in the Missouri River Basin since about 1946, the dating of the beginnings of sedentary farming cultures in the Dakotas is not exactly known, but Wedel (1961) considers it later than the beginning of Upper Republican farther south. In central South Dakota, Lehmer (1954) and others recognize a blending of two traditions: one from the East and one from the Central Plains, of which Upper Republican is a classic example. The fact that this blending took place apparently well after the beginning of the Central Plains tradition helps support a southern or southwestern origin of maize in the Plains.

Later sites in the Plains, most of them dating from after ca. A.D. 1600, have yielded specimens of maize with a very significant percentage of eight-rowed cobs that are predominantly Maíz de Ocho. At some sites, the maize is entirely eight-rowed. Farther east, across the northern United States, Brown and Anderson (1947) showed the same pattern, with a general tendency for the percentage of eight-rowed specimens to be higher in the extreme north. Furthermore, all the sites across the northern United States from which specimens of maize have been collected are apparently of a date later than ca. A.D. 1000 (Brown and Anderson, 1947). As the area of maize cultivation expanded north, natural selection would have played a very important part in filtering out Maiz de Ocho germplasm in the form of the Northern Flint, which was the sole historic Indian maize from the Dakotas across the northern United States to the Atlantic Ocean.

In any case, the introduction of Maíz de Ocho into what is now the United States probably did more to change the way of life of more of its people in a short time than did any other single prehistoric innovation.

Furthermore, if additional archaeological and botanical work bears out the reconstruction of the history of Maíz de Ocho here outlined, and we think that it may, the solution of many local archaeological problems will be greatly facilitated, and an understanding of the original source of Northern Flint germplasm should advance the field of hybrid maize breeding.

Acknowledgments

Sincere appreciation is expressed to Dr. Paul C. Mangelsdorf, Director of the Botanical Museum, for his suggestions and encouragement during the course of the investigation; to Dr. J. O. Brew, Director of the Peabody Museum, for permission to examine the various collections of maize, including previously unreported material; to Drs. Mangelsdorf, Brew and R. S. MacNeish for their critical reading of the manuscript; to Dr. Volney H. Jones of the Museum of Anthropology at the University of Michigan for providing us with critical maize cobs from the Davis Site in Texas and the Durango Site in Colorado; to Dr. Charles J. Bareis of the Department of Anthropology, University of Illinois for providing material from the Cahokia area in Illinois which was examined in Urbana; and to Dr. E. J. Wellhausen of the Rockefeller Foundation for supplying certain critical ears of Mexican races of maize for comparison with our archaeological specimens.

TABLE I. Distribution of eight-rowed archaeological maize. Only specimens which show clear evidence of Maíz de Ocho are included in the percentages from collections which we examined. Collections containing fewer than five specimens are marked (*). Few of the sites have been precisely dated so most of the dates must be considered close approximations.

State and (County)	*Site and (Cultural Affiliation)*	*Date A.D.*	*% 8 Row*	*Reference*
CHIHUAHUA	Waterfall Cave	1100–1600	36	Cutler (1960)
	Swallow Cave, Level I	ca.900	33	Mangelsdorf & Lister (1956)
	Swallow Cave, Level II	ca.1000	17	Mangelsdorf & Lister (1956)
ARIZONA				
Pima	Reeve Ruin (Western Pueblo)	1250–1550	66	Cutler *in:* DiPeso (1958)
Gila	Richards Cave (Sinagua)	1100–1200	29	Galinat *et al.* (1956)
Navajo	Painted Cave (Kayenta Anasazi)	1247	20	Haury (1945)
Apache	Cave 8 (Kayenta Anasazi)	800–1200		Guernsey & Kidder (1921)
?	Antelope Cave	1000–1150	12	Cutler & Bower *in:* Adams *et al.* (1961)
NEW MEXICO				
Grant	Cave, Mouth of Shelley Canyon (Mogollon)	700–1200	33*	Peabody Mus. Cat. 97439 & Cosgrove (1947)
Catron	Kelly Cave (Mogollon)	700–1200	59	Peabody Mus. Cat. A7251 & Cosgrove (1947)
Catron	Tularosa Cave, Level 4	700–	62	Cutler (1952)
(Mogollon)	Level 3		73	
	Level 2		63	
	Level 1	1200	67	
UTAH				
San Juan	NA6456 (Anasazi)	1100–1300	24	Cutler & Bower *in:* Adams *et al.* (1961)
San Juan	NA3732 (Anasazi)	1150–1200	33	Cutler & Bower *in:* Adams *et al.* (1961)
San Juan	NA6813 (Anasazi)	?	29	Cutler & Bower *in:* Adams *et al.* (1961)
Wayne	Morss 21 (Fremont)	950–1200	50*	Peabody Mus. Cat. A6466 & Morss (1931)
Wayne	Morss 37 (Fremont)	950–1200	100*	Peabody Mus. Cat. A6819 & Morss (1931)
Wayne	FL 12–4 (Fremont)	950–1200	25*	Peabody Mus. Cat. 33–2–10–196, Gunnerson, (n.d. b)
Sevier	Old Woman (Fremont)	950–1200	?	Taylor (1957)

TABLE I (*cont.*)

Sevier	Snake Rock (Fremont)	950–1200	10	Gunnerson (n.d. a)
Grand	Turner-Look (Fremont)	950–1200	?	Nickerson *in:* Wormington (1955)
Uintah	ET 6–3 (Fremont)	950–1200	3	Peabody Mus. Cat. A7612 & Gunnerson (n.d. b)
Carbon	PR 4–27 (Fremont)	950–1200	33	Peabody Mus. Cat. A7984 & Gunnerson (n.d. b)
Uintah	A 6–1 (Fremont)	950–1200	7	Peabody Mus. Cat. A7944, A7945 & Gunnerson (n.d. b)
Grand	Luster Cave	900–1000	33	Nickerson & Hou *in:* Wormington & Lister (1956)
TEXAS				
Cherokee	Davis Site	ca.800–1000	?	Jones (1949)
KANSAS				
Rice	Tobias Site	ca.1550	20	Brown & Anderson (1947)
Doniphan	Doniphan Site	ca.1750	29	Brown & Anderson (1947)
Doniphan	Fanning Site (Oneota)	ca.1700–	50*	Brown & Anderson (1947)
MISSOURI				
Platte	Steed Kisker	1600–1800	40	Brown & Anderson (1947)
McDonald	Jane	?	?	Brown & Anderson (1947)
NEBRASKA				
Knox	Ponca Fort	1800	100	Brown & Anderson (1947)
Boyd	Lynch	ca.1500	40	Brown & Anderson (1947)
Douglas	A–3 (Nebraska Culture)	1100–1550	27	Peabody Mus. Cat. 82528
Douglas	Debelka C (Nebraska Culture)	1100–1550	39	Peabody Mus. Cat. 90409
Douglas	Wright Place (Nebraska Culture)	1100–1550	65	Peabody Mus. Cat. 90579
Frontier	Medicine Creek, Misc. (Upper Republican)	1000–1550	?	Kivett (1949; 280)
SOUTH DAKOTA				
Stanley	Phillips Ranch (Snake Butte Focus)	1750–1800	100	Lehmer (1954)
Stanley	Dodd Site (Stanley Focus)	1700–1750	100	Lehmer (1954)
?	Elk Creek (Historic Arikara)	ca.1800	100	Brown & Anderson (1947)
Corson	Leavenworth (Historic Arikara)	ca.1800	100	Brown & Anderson (1947)

TABLE I (*cont.*)

Corson	Rygh	1750–1800	25*	Brown & Anderson (1947)
ILLINOIS				
Madison	Cahokia Mound			Bareis, personal communication
MICHIGAN				
Wayne	Gibralter		100*	Brown & Anderson (1947)
OHIO				
Lancaster	Kettle Hill		78	Brown & Anderson (1947)
Lancaster	Baldwin		100*	Brown & Anderson (1947)
?	Gartner Village (Fort Ancient)	ca.1500	100*	Brown & Anderson (1947)
?	Fuert (Fort Ancient)	ca.1500	33	Brown & Anderson (1947)
?	Baum	ca.1350	100*	Brown & Anderson (1947)
?	Madisonville Mound	1600–1700	71	Brown & Anderson (1947)
NEW YORK				
Sackett	Sackett Co. (Owasco)	ca.1000	91	Brown & Anderson (1947)
?	Silver Wheels (Iroquois)	ca.1500	50*	Brown & Anderson (1947)
SOUTH CAROLINA				
Kershaw	McDowell Mound		40	Brown & Anderson (1947)
GEORGIA				
Columbia	Stallings Mound	probably after 1600	50	Brown & Anderson (1947) and Claflin (1939)
ALABAMA				
?	Guntersville Basin TVA		25	Brown & Anderson (1947)
Houston	Seaborn Mound (Fort Walton)	ca.1400	67	Neumann (1961)
KENTUCKY				
?	Kings Mõund		20	Brown & Anderson (1947)

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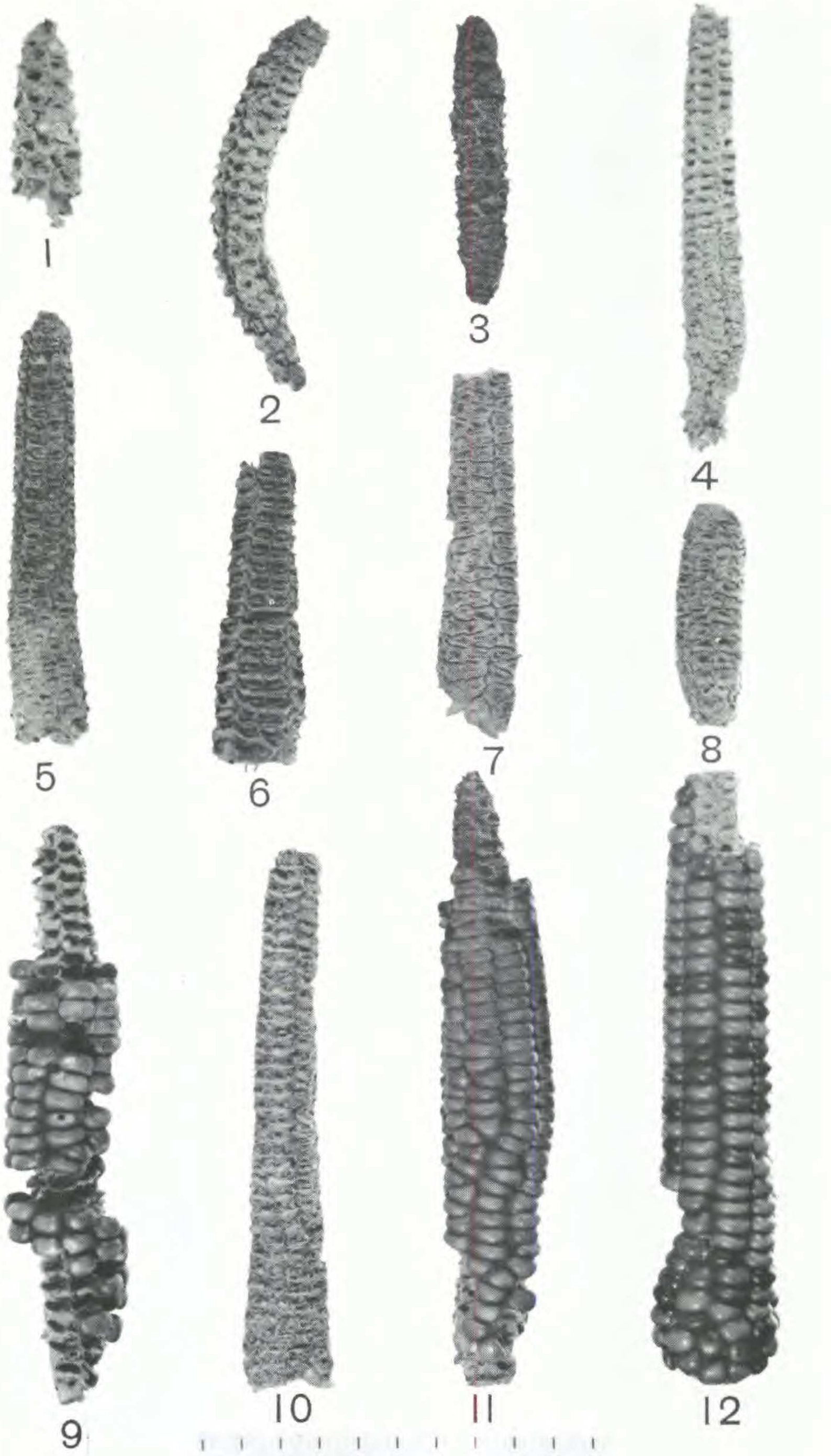
ILLUSTRATIONS

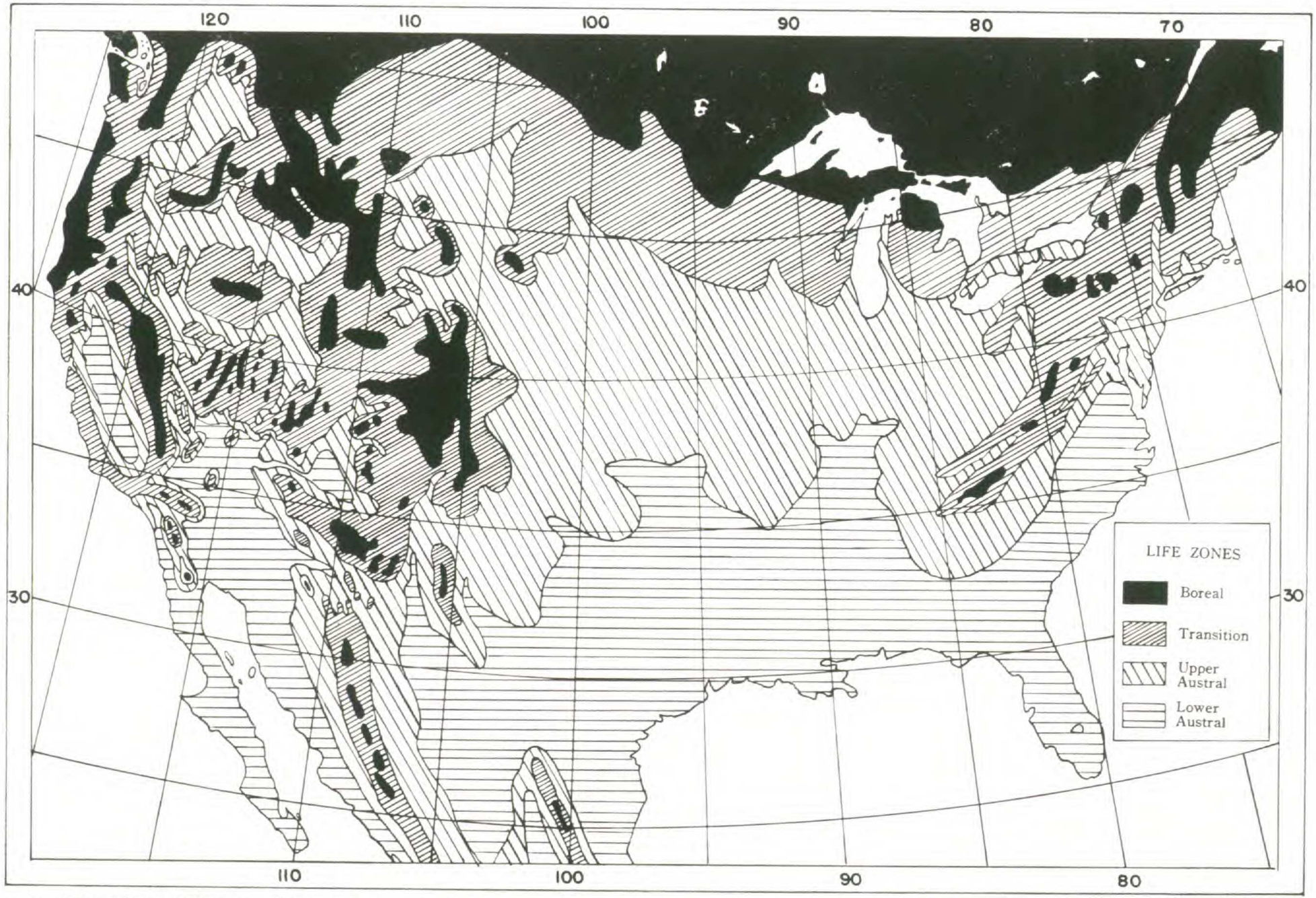
EXPLANATION OF THE ILLUSTRATION

PLATE XX. Eight-rowed cobs from various sites in the Southwest. Figs. 1–4 are probably just tripsacoid Chapalote types, as is reflected in their slender rachis, tapered butt, narrow cupules and indurated upcurved glumes. Figs. 5–12 represent the new eight-rowed race, Maíz de Ocho, as is reflected in their thick straight rachis, swollen butt and wide cupules.

Fig. No.	*Cultural Affiliation and Date A.D.*	*Provenience and Reference*	*Peabody Museum Catalogue No.*
1	Fremont (950–1200)	Site PR 3–31. 30 mi. NW of Price, Utah. Gunnerson (n.d. b)	A7800
2	Fremont (950–1200)	Site PR 3–31. 30 mi. NW of Price, Utah. Gunnerson (n.d. b)	PR 4–31
3	Fremont (950–1200)	Site PR 3–31. 30 mi. NW of Price, Utah. Gunnerson (n.d. b)	A7761
4	Fremont (950–1200)	Site PR 3–31. 30 mi. NW of Price, Utah. Gunnerson (n.d. b)	A7800
5	Fremont (950–1200)	Site ET 6–3. 60 mi. S of Vernal, Utah. Gunnerson (n.d. b)	A7612
6	Fremont (950–1200)	Site A 6–1. 6 mi. NW of Vernal, Utah. Gunnerson (n.d. b)	A7945
7	Fremont (950–1200)	Site PR 4–27. 30 mi. NW of Price, Utah. Gunnerson (n.d. b)	A7984
8	Fremont (950–1200)	Site PR 4–27. 30 mi. NW of Price, Utah. Gunnerson (n.d. b)	A7984
9	Kayenta Anasazi (700–1250)	Cave 8. NW of Kayenta, Arizona. Guernsey and Kidder (1921 : 34)	A3520
10	Fremont (950–1200)	Site FL 12–4, 8 mi. E of Fruita, Utah. Gunnerson (n.d. b)	10/196
11	Fremont (950–1200)	Site 21. 15 mi. S of Fruita, Utah. Morss (1931 : 11–12)	A6466
12	Fremont (950–1200)	Site 37. 11 mi. N of Fruita, Utah. Morss (1931 : 27)	A6819

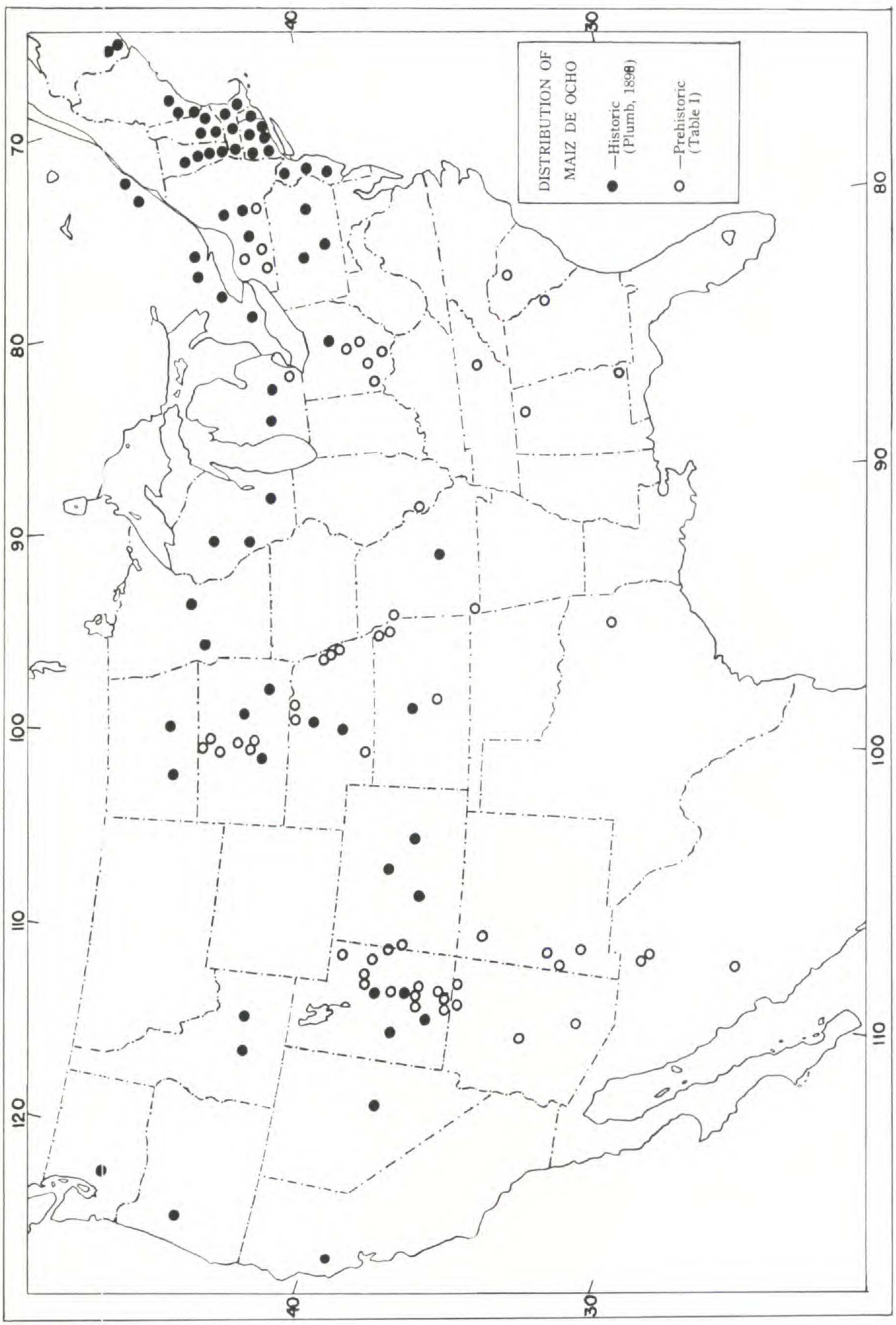
Plate XX





Adapted with modifications from Plumb (1898)

PLATE XXII

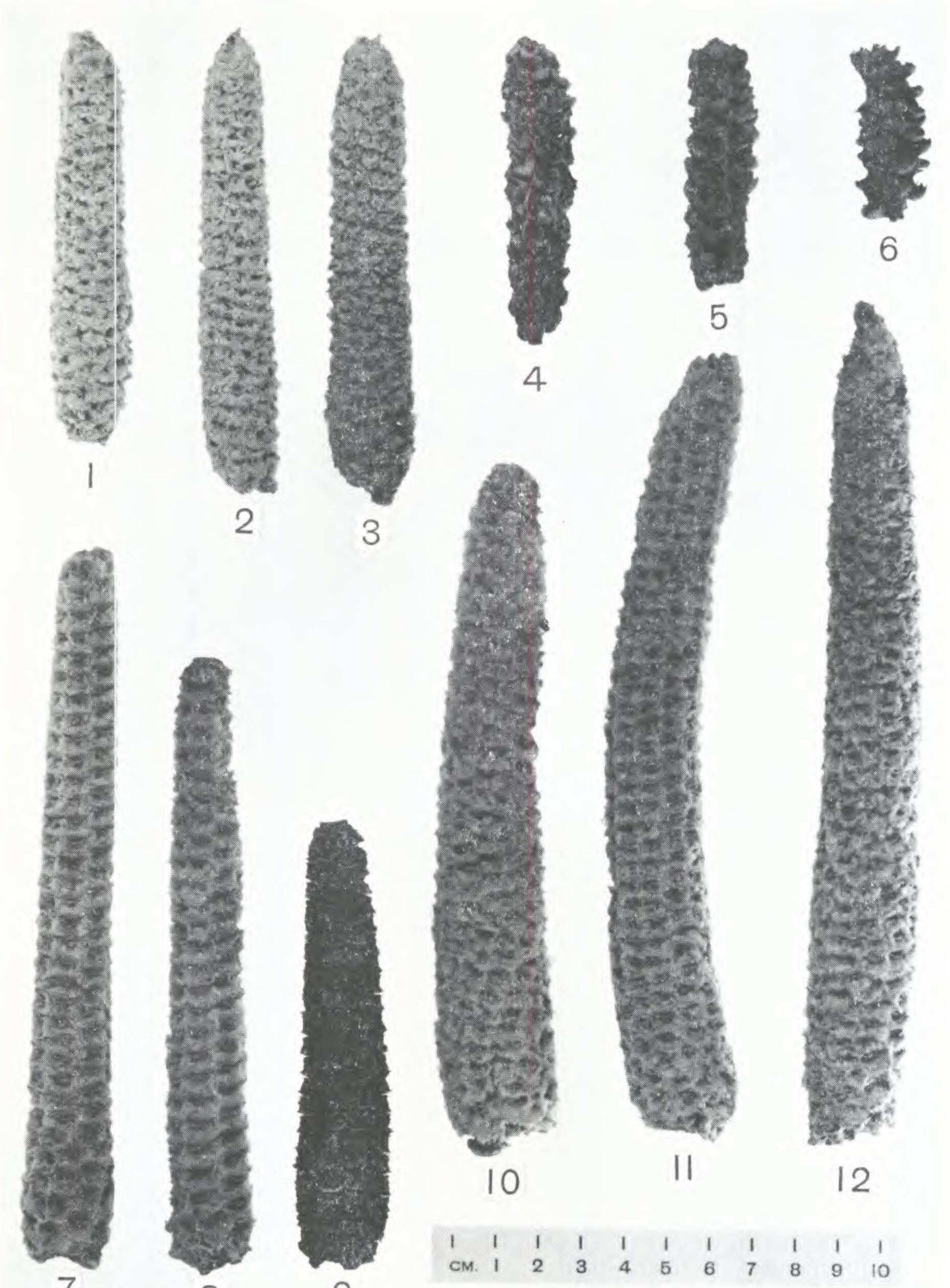

DISTRIBUTION OF
MAIZ DE OCHO
—Historic
(Plumb, 1898)
—Prehistoric
(Table 1)
40
30
70
80
90
100
110
120

EXPLANATION OF THE ILLUSTRATION

PLATE XXIII. Variation in cobs from sites in southwestern New Mexico after the introduction of Maiz de Ocho. Some of the representative Chapalote types (figs. 1–3) remain together with highly tripsacoid forms of Chapalote (figs. 4–6) as well as nearly pure types of the Maiz de Ocho (figs. 7–9) and their most productive hybrid products which approach the best ears of modern Pueblo (figs. 10–12).

Fig. No.	*Cultural Affiliation and Date A.D.*	*Provenience and Reference*	*Peabody Museum Catalogue No.*
1	Mogollon (?–1200)	Cave 7, 26 mi. NE of El Paso, N.M. Cosgrove (1947 : 38)	96848
2	Mogollon (?–1200)	Cave 7, 26. mi. NE of El Paso, N.M. Cosgrove (1947 : 38)	96848
3	Mogollon (?–1200)	Cave 7, 26 mi. NE of El Paso, N.M. Cosgrove (1947 : 38)	96848
4	Mogollon (?–1200)	Kelly Cave, 10 mi. N of Alma, N.M. Cosgrove (1947 : 25–26)	A7251
5	Mogollon (?–1200)	Cave 2, W. Fork of Gila R. 20 mi. E of Alma, N.M. Cosgrove (1947 : 22)	96959
6	Mogollon (?–1200)	Cave 1, Middle Fork, Gila R. 25 mi. E of Alma, N.M. Cosgrove (1947 : 20)	79010
7	Mogollon (?–1200)	Near mouth of Shelley Canyon, 25 mi. SE of Alma, N.M. Cosgrove (1947)	97439
8	Mogollon (?–1200)	Kelly Cave, 10 mi. N of Alma, N.M. Cosgrove (1947 : 25–26)	A7251
9	Mogollon (?–1200)	Kelly Cave, 10 mi. N of Alma, N.M. Cosgrove (1947 : 25–26)	A7351
10	Mogollon (?–1200)	Steamboat Cave, 30 mi. SE of Alma, N.M. Cosgrove (1947 : 10–13)	97143
11	Mogollon (?–1200)	Steamboat Cave, 30 mi. SE of Alma, N.M. Cosgrove (1947 : 10–13)	97143
12	Mogollon (?–1200)	Steamboat Cave, 30 mi. SE of Alma, N.M. Cosgrove (1947 : 10–13)	97143

Plate XXIII

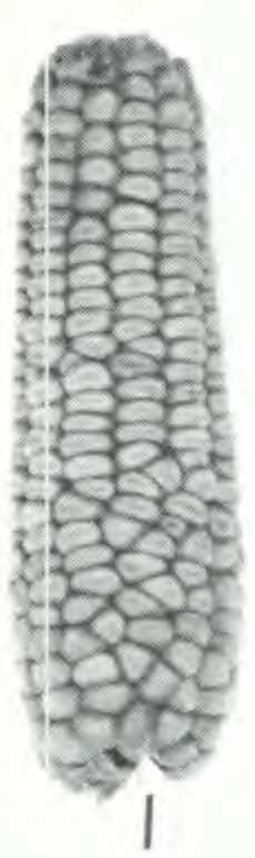


EXPLANATION OF THE ILLUSTRATION

PLATE XXIV. Prehistoric dent maize from various sites in the Fremont area of Utah. Fig. 4, which is from the southeast corner of this area, is slightly older than the other specimens and is essentially a dented form of Chapalote. The rest of the specimens involve Maiz de Ocho as well as Chapalote and teosinte in their origin.

Fig. No.	*Cultural Affiliation and Date A.D.*	*Provenience and Reference*	*Peabody Museum Catalogue No.*
1	Fremont (950–1200)	Site 21. 15 mi. S of Fruita, Utah. Morss (1931: 11–12)	A6466
2	Fremont (950–1200)	Site PR 4–31. 30 mi. NW of Price, Utah. Gunnerson (n.d. b)	A7769
3	Fremont (950–1200)	Site A 6–1. 6 mi. NW of Vernal, Utah. Gunnerson (n.d. b)	A7944
4	Basketmaker (200–700)	Site SR 16–6. 35 mi SE of Hanksville, Utah. Gunnerson (n.d. b)	10/264
5	Fremont (950–1200)	Site 19. 15 mi. S of Fruita, Utah. Morss (1931: 10–11)	A6478
6	Fremont (950–1200)	Site 19. 15 mi. S of Fruita, Utah. Morss (1931: 10–11)	A6478
7	Fremont (950–1200)	Site 19. 15 mi. S of Fruita, Utah. Morss (1931: 10–11)	A6520
8	Fremont (950–1200)	Site PR 4–28. 30 mi. NW of Price, Utah. Gunnerson (n.d. b)	A7736
9	Fremont (950–1200)	Site A 6–1. 6 mi. NW of Vernal, Utah. Gunnerson (n.d. b)	A7936
10	Fremont (950–1200)	Site A 6–1. 6 mi. NW of Vernal, Utah. Gunnerson (n.d b)	A7944
11	Fremont (950–1200)	Site A 6–1. 6 mi. NW of Vernal, Utah. Gunnerson (n.d. b)	A7944
12	Fremont (950–1200)	Site A 6–1. 6 mi. NW of Vernal, Utah. Gunnerson (n.d. b)	A7944

Plate XXIV



1

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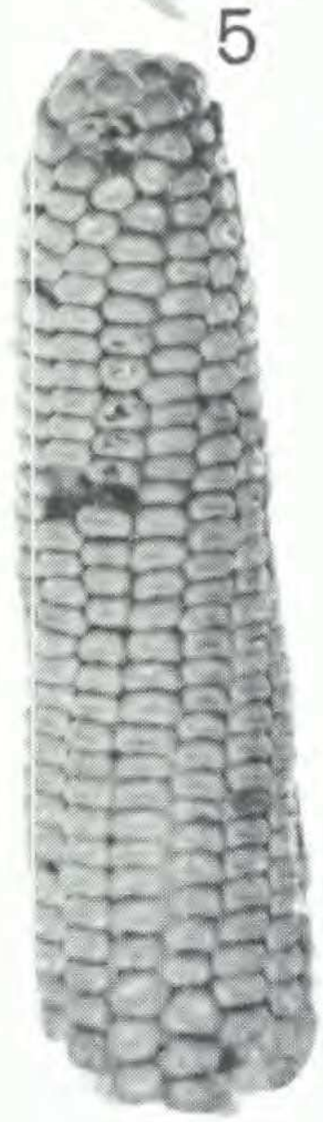
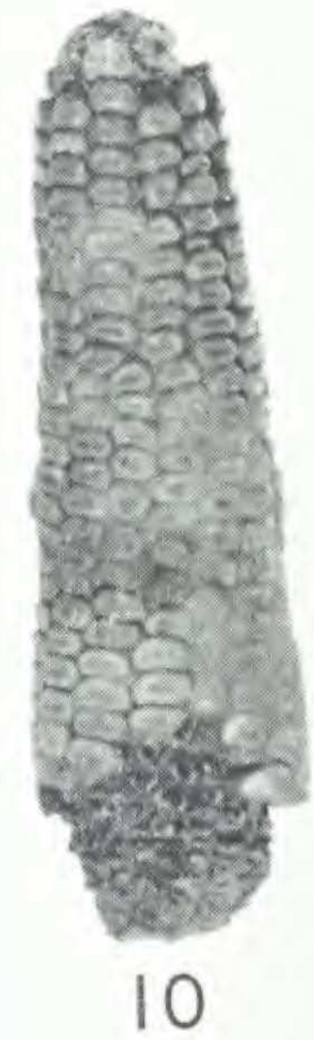


9



10

11

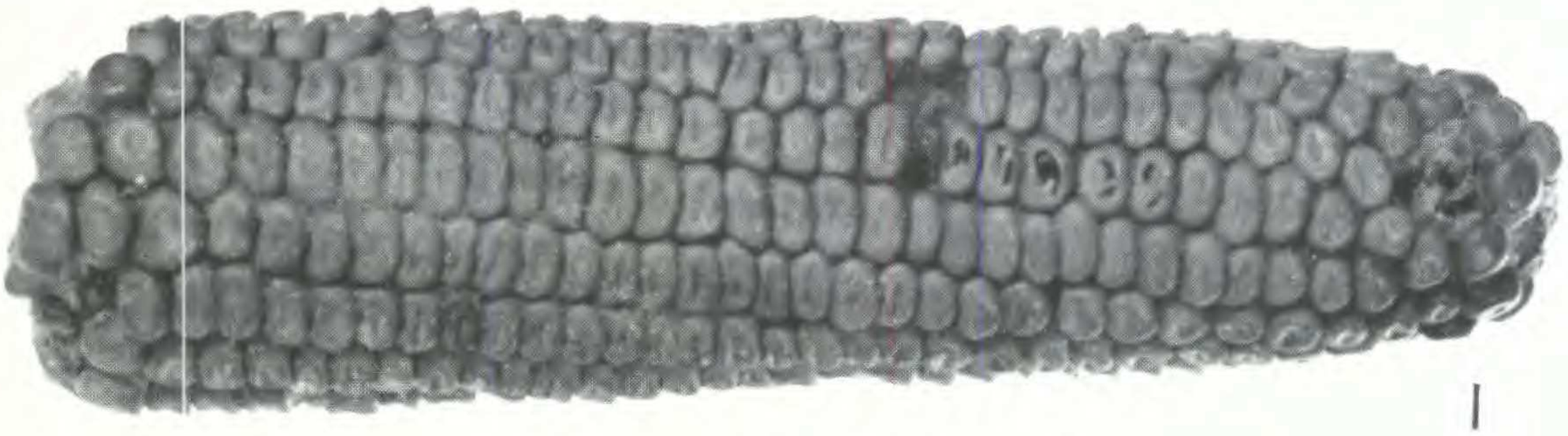
12

EXPLANATION OF THE ILLUSTRATION

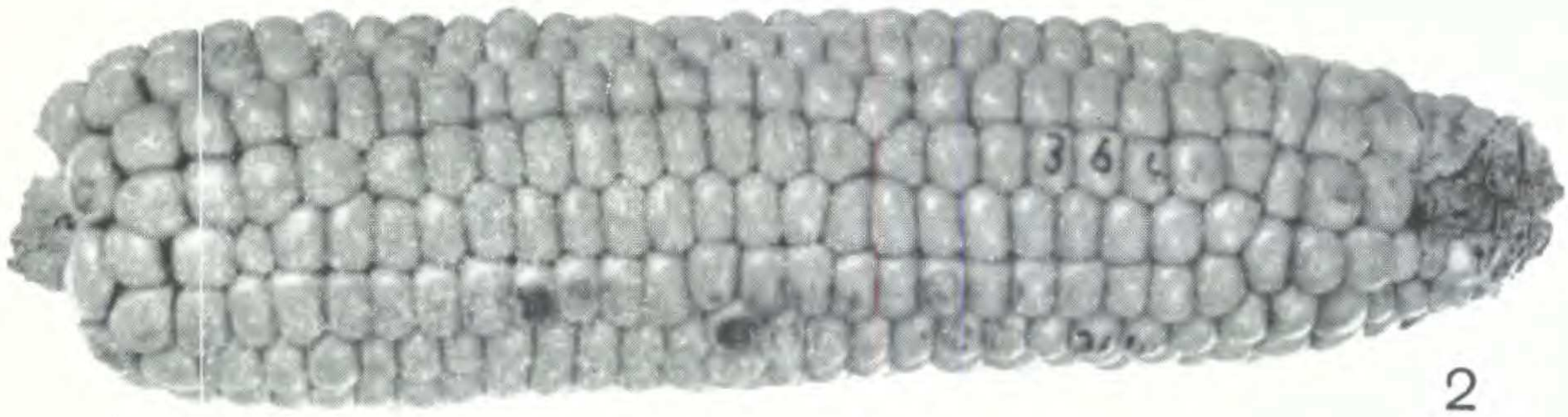
PLATE XXV. Illustration of the close similarities among the races Maize Blando de Sonora, Pima-Papago and Fremont Dent.

Fig. No.	*Cultural Affiliation and Date A.D.*	*Provenience and Reference*	*Peabody Museum Catalogue No.*
1	Fremont (950–1200)	Site 19. 12 mi. S of Fruita, Utah. Morss (1931 : 10)	A6520
2	Hopi Pueblo 1880	Hopi Pueblo, 80 mi. NE of Flagstaff, Arizona	3641
3	Maize Blando de Sonora, modern	E. J. Wellhausen, Rockefeller Foundation, Mexico	

PLATE XXV

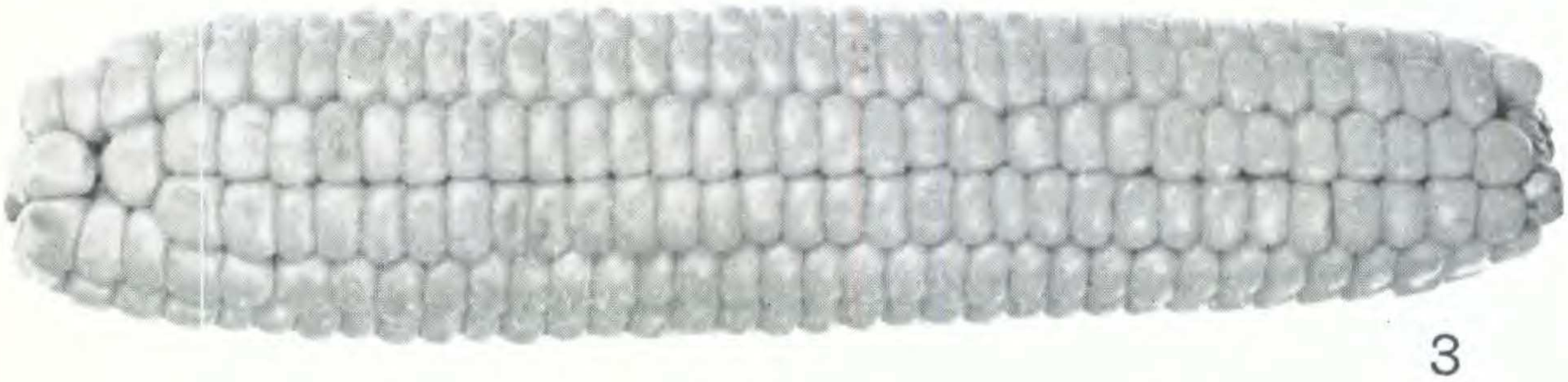


FREMONT DENT



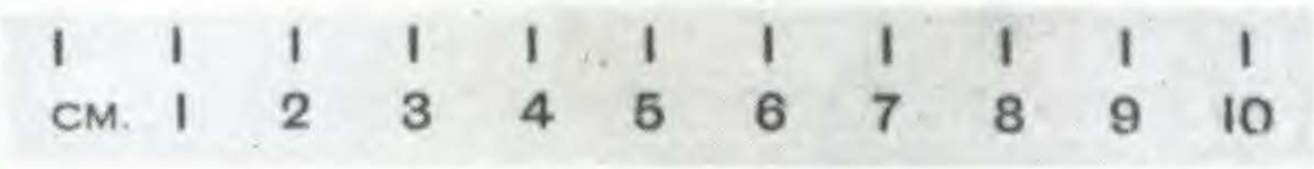
2

PIMA–PAPAGO



3

MAIZE BLANDO DE SONORA

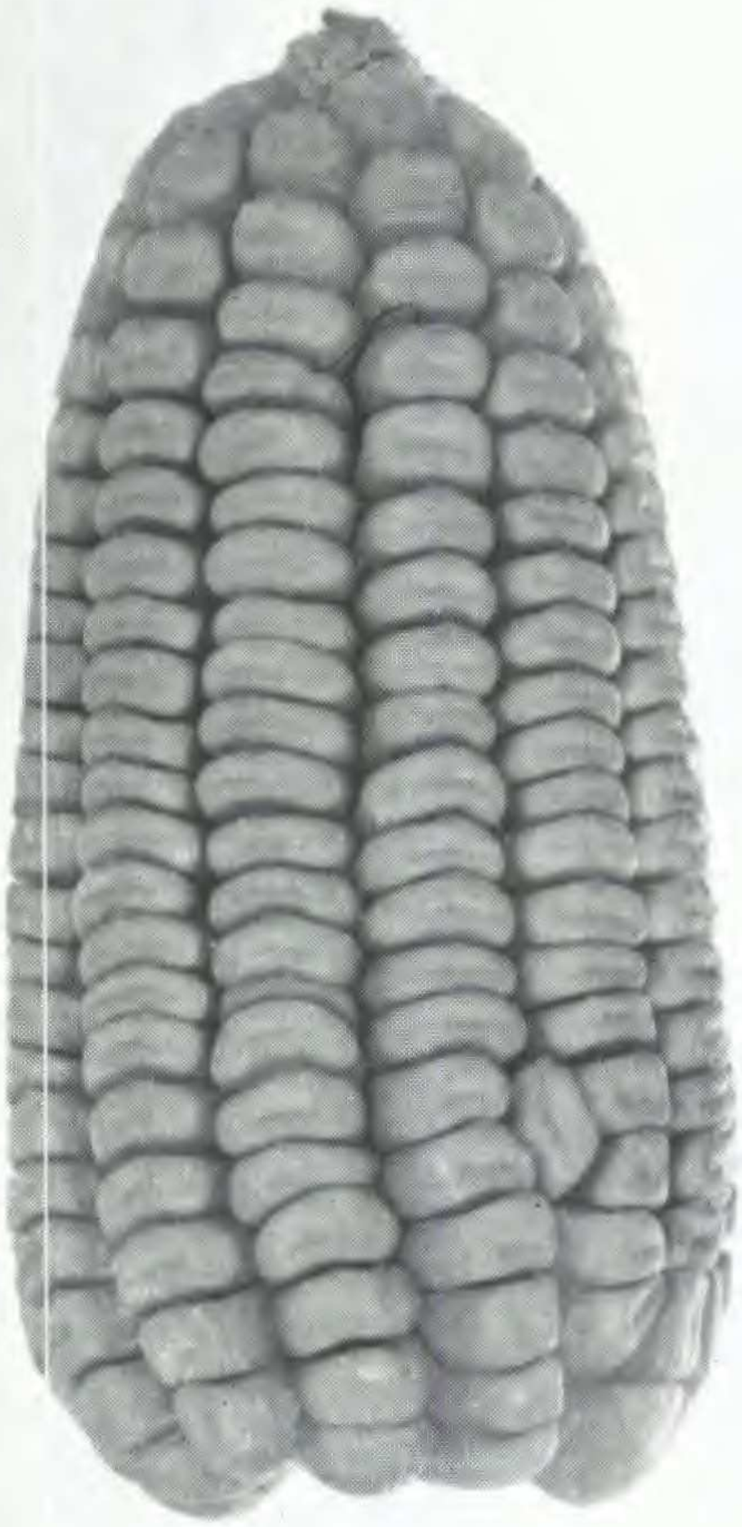


EXPLANATION OF THE ILLUSTRATION

PLATE XXVI. A comparison of the most Zapalote Chico-like archaeological specimen available to us from Fremont sites to actual Zapalote Chico.

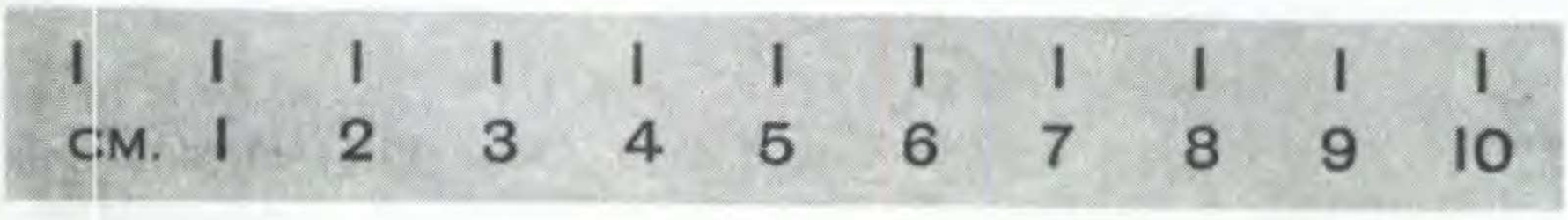
Fig. No.	*Cultural Affiliation and Date A.D.*	*Provenience and Reference*	*Peabody Museum Catalogue No.*
1	Zapalote Chico modern	E. J. Wellhausen, Rockefeller Foundation, Mexico	
2	Fremont (950–1200)	Site A 6–1. 6 mi. NW of Vernal, Utah. Gunnerson (n.d. b)	A7944

Plate XXVI



1

2



EXPLANATION OF THE ILLUSTRATION

PLATE XXVII. The evolutionary sequence in maize in the Southwest, as herein presented, is summarized in a pictorial manner in this plate. In the lower-right-hand corner is an example of pre-Chapalote, the first race to appear in the Southwest (about 5000 years ago). When teosinte introgression was introduced into this race at about 500 B.C., it produced the Early and Evolved Chapalote types shown just above. About A.D. 700 a new eight-rowed race, possibly derived from Cabuya of South America, arrived in the Southwest, where it also hybridized with the indigenous types of Chapalote. Sometimes this eight-rowed race reasserted itself in the resulting segregations, except for acquiring flinty kernels, as shown by the vertical ear labeled Maiz de Ocho–S.W. Flint on the lower left, or nearly reasserted itself as illustrated by the adjacent ear, Near Maiz de Ocho. More frequently the truly intermediate conditions such as the Fremont Dent type in the northern part of the Southwest, the Pima-Papago type above it from the southern part of the Southwest or, still farther south, Maiz Blando from the Mexican state of Sonora came to predominate. Even more productive hybrids eventually evolved from the blending of Harinoso de Ocho, Chapalote and teosinte to yield such large ears as those of the Pueblo race (top center right) and its Mexican counterpart, Cristalino de Chihuahua (top center left).

Modern counterparts of prehistoric Chapalote and Maíz de Ocho can still be found growing in areas where they became well adapted. In the upper left corner are modern survivors, apparently only slightly changed, of the Maíz de Ocho which entered the Southwest about A.D. 700. The three modern (1961) ears of Chapalote in the upper right corner match off precisely with the nearly 2000-year-old ears of Early and Evolved Chapalote. The ear of Maíz Blando de Sonora is a modern counterpart of the Fremont Dent and Pima-Papago maize which have persisted for the last 1000 years. (The provenience is given in Table II.)

Plate XXVII

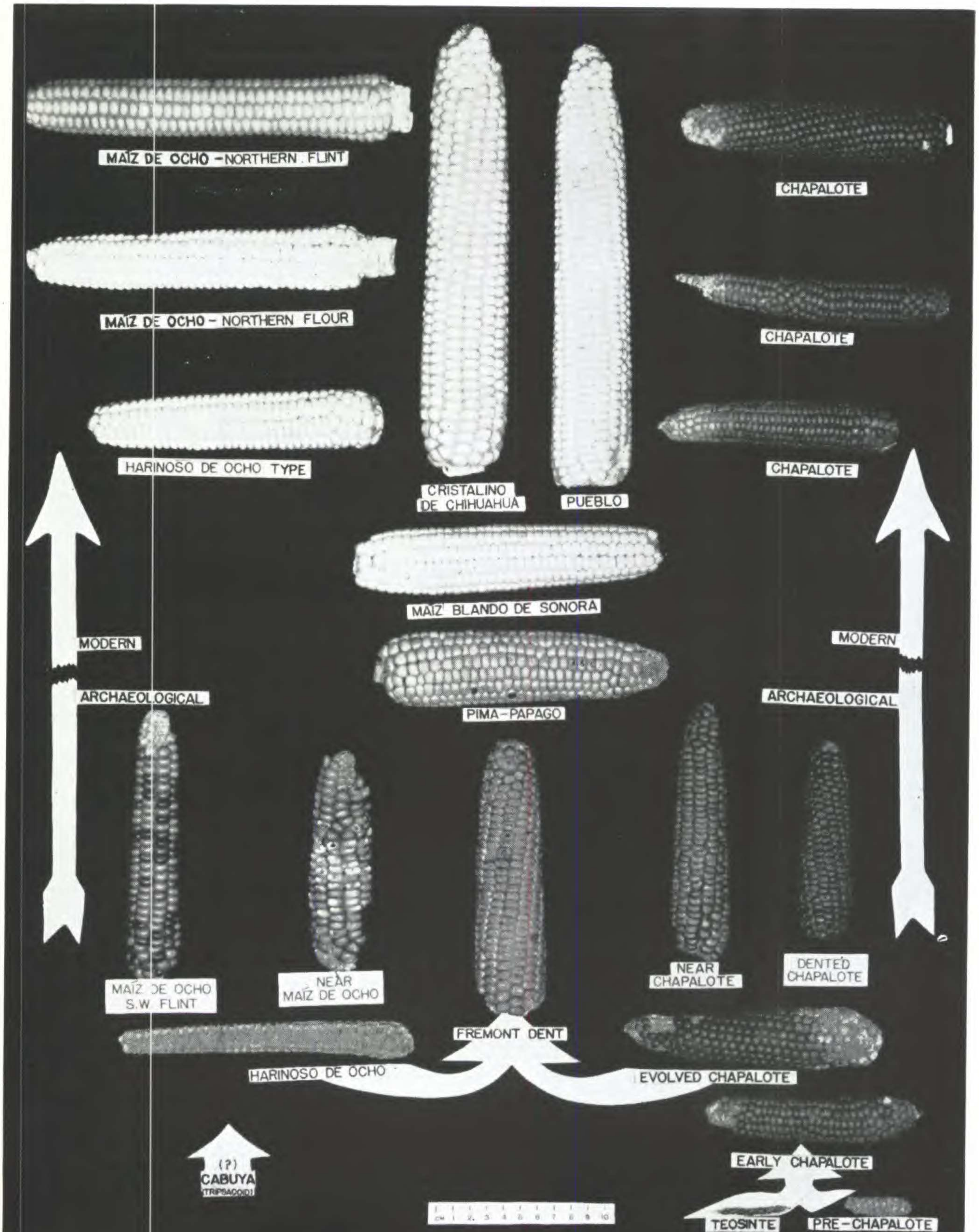

MAÍZ DE OCHO – NORTHERN FLINT
MAÍZ DE OCHO – NORTHERN FLOUR
HARINOSO DE OCHO TYPE
CRISTALINO DE CHIHUAHUA
PUEBLO
CHAPALOTE
CHAPALOTE
CHAPALOTE
MAÍZ BLANDO DE SONORA
MODERN
MODERN
ARCHAEOLOGICAL
ARCHAEOLOGICAL
PIMA – PAPAGO
MAÍZ DE OCHO S.W FLINT
NEAR MAÍZ DE OCHO
NEAR CHAPALOTE
DENTED CHAPALOTE
FREMONT DENT
HARINOSO DE OCHO
EVOLVED CHAPALOTE
(?) CABUYA (TRIPSACOID)
EARLY CHAPALOTE
TEOSINTE
PRE – CHAPALOTE

TABLE II. Provenience of specimens illustrated in Plate XXVII.

Archaeological Specimen	*Cultural Affiliation and Age*	*Provenience and Reference*	*Peabody Museum Catalogue No.*
Maíz de Ocho S.W. Flint	Fremont (A.D. 950–1200)	Site 37. 11 mi. N of Fruita, Utah. Morss (1931, p. 27)	A6819
Near Maíz de Ocho	Kayenta Anasazi (A.D. 700–1250)	Cave 8. NW of Kayenta, Arizona. Guernsey & Kidder (1921, p. 34)	A3520
Fremont Dent	Fremont (950–1200)	Site A 6–1, 6 mi. NW of Vernal, Utah. Gunnerson (n.d. b)	A7936
Near Chapalote	Basketmaker (A.D. 200–700)	Site SR 16–6, 40 mi. SE of Hanksville, Utah. Gunnerson (n.d. b)	10/264
Dented Chapalote	Fremont (A.D. 950–1200)	Site PR 4–31, 30 mi. NW of Price, Utah. Gunnerson (n.d. b)	A7769
Harinoso de Ocho	Mogollon (A.D. 700–1200)	Kelly Cave. 10 mi. N of Alma, N.M. Cosgrove (1947: 25–26)	97439
Evolved Chapalote	Basketmaker (A.D. 100–500)	Cave II, Marsh Pass, SW of Kayenta, Arizona. Kidder & Guernsey (1919, pp. 82–90)	A2481
Early Chapalote	Basketmaker (A.D. 100–500)	Cave II, Marsh Pass, SW of Kayenta, Arizona. Kidder & Guernsey (1919, pp. 82–90)	A2481
Pre-Chapalote	1600–300 B.C.	Coxcatlan Cave, Zone H. Tehuacan, Mexico. MacNeish (1962)	

Modern Specimens	*Provenience*
Harinoso de Ocho Type	modern grown by Hidatsa Indians and identical to Harinoso de Ocho of Wellhausen *et al.*, 1952.
Northern Flour	modern grown by Mandan Indians, N. Dakota.
Northern Flint	modern from New England.
Chapalote (three ears)	from E. J. Wellhausen, grown in Mexico, 1961.
Maíz Blando de Sonora	from E. J. Wellhausen, grown in Mexico, 1961.
Pima-Papago	collected in 1880 at Hopi Pueblos, N. Arizona. Peabody Museum Catalog No. 3641.
Cristalino de Chihuahua	from E. J. Wellhausen, grown in Mexico, 1961.
Pueblo	modern grown by Pueblo Indians.